

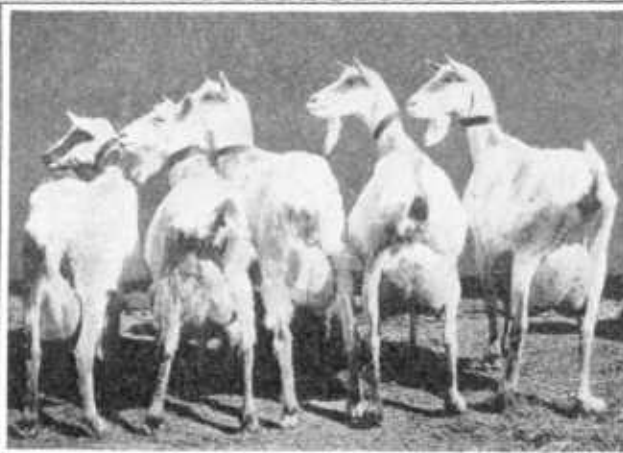
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U. S. DEPARTMENT OF
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FARMERS' BULLETIN No. 920

MILK
GOATS



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U. S. DEPARTMENT OF AGRICULTURE

THE PRODUCTION of milk goats has for a great many years been an important feature of the livestock industry in many European countries, but it has never had a very strong foothold in the United States. In this country the goat has always been an animal of more or less ridicule, as the majority of the people do not realize the possibilities of certain breeds or types that have been bred for many years along definite lines.

In continental Europe milk goats are largely used by families unable to keep a cow, and great benefit is derived from having fresh milk at hand at a low cost. In those countries the goat is often spoken of as the "poor man's cow."

During the past several years considerable interest has been manifested in the milk-goat industry in this country. The fact that the goat will supply sufficient milk for the average family and can be kept where it would be impossible to keep a cow is beginning to appeal to many people, especially those living in small towns and the suburbs of the large cities.

The milk-goat industry is only in its infancy in the United States. The milk goat is adapted to our country, and the milk-goat industry should become more important as people become better acquainted with the advantages of milk goats for certain purposes.

Washington, D. C.

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MILK GOATS

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PRESENT STATUS OF THE INDUSTRY

THE MILK-GOAT industry in the United States has not as yet developed to any important extent. The interest shown in it in the past has come largely from people who were either reared in, or at least are familiar with conditions in, countries where the milk goat has been a success. It requires time to educate people to the value of any new industry, especially one that has been so greatly handicapped as the milk-goat industry has been. In Switzerland, Italy, Germany, France, Norway, and Spain, milk goats are largely used by families not so situated as to be able to keep a cow. F. S. Peer, a well-known American importer of livestock, after making an investigation of the industry in Switzerland, stated that "the goat of Switzerland is the Swiss peasant's cow and Swiss baby's foster mother, a blessing to the sanitariums for invalids, and a godsend to the poor."

In England and in many other parts of Europe people who leave the cities during the summer months either for their country homes or for travel often take a milk goat with them so that the infant or other members of the family may have a good supply of milk of uniform quality. Similar instances have been recorded in this country. No other animal is so well adapted for such a purpose, and there is probably no other country where goats are so much needed for such a purpose as in the United States.

The industry in the past has been greatly handicapped owing to the scarcity of good goats for foundation herds. Only a few goats have been imported, as will be noted later in discussing the different breeds. Importations cannot be made at the present time from most of the countries where desirable goats are produced. But the goats that have been imported have been rather widely distributed, and most of them seem to have done well in their new environment.

The milk goat is adapted to this country, and the industry is likely to become of greater importance every year. The goat is

¹ This is a revision of former editions by Edward L. Shaw.

especially useful to those who desire a small quantity of milk and do not have the room or cannot afford to keep a cow. In fact, a goat can be kept where it would be impossible to keep a cow, and it will consume considerable feed that otherwise would be wasted. The fact that goats are rarely affected with tuberculosis is another point in their favor. The demand for good goats appears to be far greater than the supply.

GOATS' MILK

YIELD

About the first question that most people ask concerning milk goats is, "How much milk will one produce?" This is, of course, a very important consideration, as the value of a doe is estimated largely by her milk production. Even if a doe is purebred, she is of little value from the utility standpoint unless she is capable of giving a good quantity of milk. Many persons, in purchasing grade or even purebred goats, have been disappointed to find that the milk could be measured in pints and not quarts or gallons, as expected.

A doe that produces 3 pints a day is considered only a fair milker, while a production of 2 quarts is good, and a production of 3 quarts is considered excellent, provided the lactation is maintained for from 7 to 10 months. Good does should produce from 8 to 15 times their weight in milk in a lactation period. It is stated by German writers that many goats yield 10 times their body weight of milk annually, and exceptional animals as much as 18 times their weight.

The milk-production records of the Bureau's herd of goats at the Agricultural Research Center, Beltsville, Md., have shown similar ratios to body weight. Production records of some of the outstanding does in this country, together with some records of the animals produced in the Bureau's herd, will be noted in the sections dealing with their respective breeds.

PRICES

The price to be obtained for goats' milk depends on a number of conditions. If the milk is to be sold for ordinary uses, the price, of course, will be much lower than if a special market has been developed. In the past the price has ranged from 10 to 50 cents a quart, and the highest prices have been obtained when the milk has been supplied for the use of infants and invalids. The demand and the cost of production will serve as a guide as to what price should be obtained. So long as good goats are scarce and high priced, it will be necessary to get good prices for the products, whether in the form of milk or cheese, to encourage people to engage in the industry.

There is on the market a brand of evaporated unsweetened goats' milk that retails for 25 cents a can of 6 ounces, which is equivalent to about 65 cents a quart for the original milk.

CHARACTERISTICS

Goats' milk is nearly always pure white in color. The small size of the fat globules is one of its chief characteristics. The cream rises very slowly and never so thoroughly as in the case of cows'

milk. This condition makes impracticable the ordinary method of obtaining cream by allowing it to rise. It has been stated that goats' milk will not keep sweet so long as cows' milk, but tests have shown that this is not the case. The keeping quality of any milk depends on the conditions under which it has been produced and handled.

In tests made by the Department of Agriculture it was found that goats' milk could be thoroughly separated in a separator. When milk testing 4.4 percent of fat was run through the separator and the milk separated was tested, it showed only 0.03 percent of fat.

If goats' milk is properly produced and handled, it should have no disagreeable odor or flavor. The principal sources of bad odor or flavor in the milk are particles of dirt or hair that fall into it during milking, keeping the does in unclean quarters, and milking in a barn or pens near the bucks. Bucks should never be permitted to run with the does. This practice is especially undesirable during the breeding season, when the strong odor of the buck will be transferred readily to the does by contact. The odor is quickly absorbed by the warm milk.

COMPOSITION AND NUTRITIVE PROPERTIES

At the New York Agricultural Experiment Station, at Geneva, N. Y., with a mixed herd of goats, it was found that the percentage of fat in the milk varied from 3.2 to 4.4, the solids (not fat) ranged from 7.72 to 8.61 percent, and the total solids ranged between 11.4 and 11.9 percent.² The milk of the purebred and high-grade Saanen and Toggenburg does at the Beltsville Research Center was found to be very similar in composition when analyzed. Milk of the Saanens averaged 0.1 percent higher in protein than that of the Toggenburgs, and that of the Toggenburgs in turn averaged 0.1 percent higher in butterfat and 0.2 percent higher in total solids than that of the Saanens (table 1).

TABLE 1.—*Comparison of the composition of goats' milk and that of two common breeds of dairy cows*¹

Source of milk	Water	Total solids	Fat	Protein	Lactose	Ash
	Percent	Percent	Percent	Percent	Percent	Percent
Goat ²	88.02	11.98	3.50	3.13	4.55	0.80
Holstein-Friesian.....	87.50	12.50	3.55	3.42	4.86	.68
Jersey.....	85.31	14.69	5.18	3.86	4.94	.70

¹ From Fundamentals of Dairy Science, by associates of Lore A. Rogers, 1935 edition, ch. 1, p. 19.

² Average of purebred and high-grade Saanen and Toggenburg does.

At the New York Station a chemical study of goats' milk indicated no essential difference between the constitution of its casein and that of cows' milk. Certain differences were observed in the ash as compared with the ash of both cows' milk and human milk, but the effect of these differences has not been fully studied. Recent analyses of the milk from the Bureau's herd showed no significant differ-

² Bulletin 429, New York Agricultural Experiment Station, Geneva, N. Y.

ences in the calcium, phosphorus, iron, and copper content between goats' and cows' milk.

A series of studies have been conducted by the Bureau of Animal Industry in cooperation with the Johns Hopkins University, on the bacteriological, physical, and nutritive properties of goats' milk as compared with those of the milk of Holstein-Friesian, and of Jersey cows. Under the supervision of the university, normal infants were fed milk from the three sources. The milk was boiled for 1 minute and supplemented with orange juice and cod-liver oil. No essential differences in health, general appearance, and well-being of the infants were observed, good results being obtained with each milk. The gains in weight were in proportion to the total nutritive content of the milk.

Studies on the vitamin content in the Bureau laboratories at Beltsville, Md., showed that no one milk possessed marked superiority over the other two. Jersey milk was found to contain more vitamin A, and goat milk contained more vitamins B and G. The vitamin C content of all three milks, produced in both summer and winter, was found to be low. The vitamin D content of all three milks was approximately the same. In general, the vitamin content of milk produced in summer was found to be higher than that of milk produced in winter.

No marked differences were observed in the onset of nutritional anemia in goat kids or in rats fed on an exclusive diet of goats' and of cows' milks. Likewise, nutritional anemia could be prevented or cured by the use of iron and copper salts as supplements to any of the milks, regardless of their origin.

The young rats and kids fed under controlled feeding conditions did equally well on either kind of milk provided they received the same approximate nutritive intake. The nutrient (that is, energy content) per unit volume of Jersey milk was greater than that of Holstein or goats' milk, in which it was approximately the same. In free-choice feeding, the Jersey milk generally permitted the most rapid gains in rats, due to the greater nutritive intake, with Holstein and goats' milks ranking next in the order named. In all the feeding work normal, healthy animals were used.

Studies of the bacteria in goats' milk showed 48 out of 82 aseptically drawn samples to be free of organisms. Bacterial counts of less than 1,000 organisms per cubic centimeter were commonly found in milk drawn and used for feeding purposes.

Goats' milk was found to have a much softer curd than the milk of Holstein or of Jersey cows. The curd tension of Holstein milk was about twice and that of Jersey milk about three times that of goats' milk.

In the infant-feeding studies, no attempt was made to use babies with a history of malnutrition. It is recognized that idiosyncracies of individuals for one milk or another exist. There are on record many cases in which children are able to utilize goats' milk but not cows' milk. Another property of goats' milk is the relatively small size of fat globules, which, together with its soft curd, evidently contributes toward the greater ease in the digestion of this milk.

GOATS'-MILK PRODUCTS

Goats' milk can be utilized for the same purposes as cows' milk, although for some it is not nearly so well suited. For general use, such as drinking or cooking, the milk has proved to be very satisfactory. The milk of one of the largest herds in the country is evaporated and sold in that form. Goats' milk is less satisfactory than cows' milk for making butter, but large quantities of goats'-milk cheese are manufactured, especially in Europe. Practically all publications dealing with milk goats attribute considerable importance to the use of the milk for infants and invalids.

BUTTER

Good butter can be made from goats' milk, but ordinarily very little is produced. The cream rises very slowly, and only a portion of it reaches the top. By the use of the separator, however, practically all the butterfat can be obtained. Unless artificially colored, the butter is very white and resembles lard in appearance. If colored, it resembles cows' butter in appearance, although it does not have the same texture. It can be used for the table or for cooking. Tests made by the Bureau proved that a good quality of butter could be produced when the milk and cream were properly handled and no objectionable features were present. It should be noted, however, that when a good price is obtained for the milk, it does not pay to make butter, as cows' butter can be purchased more cheaply.

CHEESE

Several varieties of cheese, known under various names, are made from goats' milk. In France, goats'-milk cheese is called *cheveret*, or *chevrotin*; in Italy, *formaggio di copra*; and in Germany, *Weichkäsen aus Ziegenmilch* (soft cheese from goats' milk). Goats'-milk cheese has a characteristic and individual flavor all its own, although the product closely resembles Limburger cheese. It is made either entirely of goats' milk or, better, with from one-fourth to one-third cows' milk; the mixture materially improves the quality of the product. The manufacturing process is simple and requires no special equipment other than a few special forms and a curing room which can be kept at a temperature of 60° F.

The fresh milk is set with commercial liquid rennet for about 45 or 50 minutes at a temperature of from 86° to 90° F. It is perhaps advantageous to add 1 percent of starter. Rennet is diluted about 20 times in cold water and added at the rate of 1 cubic centimeter (25 drops) to 10 pounds of milk. After a thin film of whey has collected on the firm coagulated milk it is cut by means of a cheese knife into pieces about the size of a walnut. After the curd has remained in the whey for 5 minutes it is gently stirred for an equal length of time, and then dipped into forms by means of a cup or a long-handled dipper. These forms are made of 3X tin, and are 4½ inches in diameter by 5 inches high. Each form has five rows of holes, the holes being about an inch apart and one-eighth of an inch in diameter.

The curd remains in the forms undisturbed until it acquires a consistency that will admit of turning. After the curd has stood from

24 to 36 hours at a temperature of 70° F. salt is applied to the surfaces, and the cheese is left on draining boards for about 24 hours. It is then placed on plain boards and carried to the curing room, which should have a temperature of 60° F. and a high humidity.

A blue mold first appears on the cheese and should be brushed off with a moistened cloth. A slimy, reddish growth, which appears to be needful in bringing about the proper ripening changes, then covers the cheese. While the curd is at first sour, it gradually becomes less so, and finally develops a sweet and agreeable flavor. When the acidity has disappeared, the cheese is in suitable condition for wrapping.

The cheese may be wrapped in parchment paper alone or in parchment paper and tinfoil; the combination seems to be more desirable, as the tinfoil aids in preventing drying, promotes ripening, and gives the package a more attractive appearance. The cheese should then be put into regular Camembert boxes. It should take 5 or 6 weeks to ripen, and when ripe should have a fine, white color and an agreeable flavor. About 4½ pounds of milk are required to make each cheese, which when fully ripe weighs about half a pound.

A satisfactory cheese of the Roquefort type may be made from goats' milk by a method similar to that outlined in bulletin 397, of the California Agricultural Experiment Station.

The type of Roquefort cheese made from goats' milk is different in both flavor and texture from that made from sheep's milk.

MILK FOR INFANTS AND INVALIDS

A great many cases in which goats' milk has proved especially valuable for infants and invalids are on record. In many of these cases other foods had been tried and did not seem to agree with the patients. The following is taken from Bulletin 429 of the New York Agricultural Experiment Station under the heading "Summary":

Extensive study of the use of goats' milk in infant feeding by Doctors Sherman and Lohnes, of Buffalo, showed that the curds of goats' milk when returned from the stomach were smaller and more flocculent than those of cows' milk. From the determination of the combined hydrochloric acid in the returned food, the authors conclude that the cows' milk had a greater stimulating effect on the stomach than goats' milk. The absorption of the food and gain in weight in comparing the two milks were indefinite for several reasons. The babies tolerated equally well similar amounts of goats' milk with cows' milk when used with the same diluents. The younger the child the more the evidence pointed toward a greater gain on goats' milk.

Goats' milk was supplied to 18 cases of children that were not thriving on any other food that had been tried. In 17 cases a satisfactory state of nutrition was established through the use of goats' milk, the beneficial results in some instances being very marked. With certain of these children their situation was regarded as serious, and their restoration to a satisfactory nutritional condition was good evidence that goats' milk is often a very desirable resort for infant feeding.

In a project carried on cooperatively by the Sea View Hospital, New York, and the Bureau of Animal Industry, the value of goats' milk for tuberculous patients was investigated. All the cases treated were pulmonary tuberculosis, varying from quiescent with slight infiltration to active, far-advanced cases with extensive infiltration and cavitation. Adolescents were preferably chosen, irrespective of sex, but in order to have as many as possible under treatment at the

same time, some as young as 6 years of age were accepted. A control was selected for each case whose condition closely resembled that of the one under treatment.

The results showed that the goats' milk cases and the controls progressed about the same. Ten of the sick cases under treatment showed a definite improvement, whereas 11 of the controls were improved. The bed cases were not weighed, but the patients able to walk were weighed weekly. The treated and the controls gained about the same weight.

GOAT DAIRIES

During the last few years a number of goat dairies have been in operation in different parts of the country. These dairies have been established both for the production of milk and for the manufacture of cheese. The largest goat dairy in the country, however, is devoted to the manufacture of condensed milk. If only a few goats are

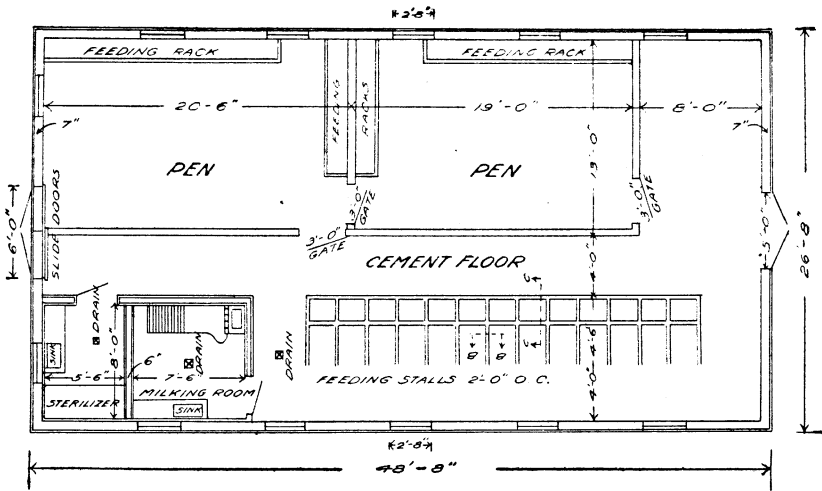


FIGURE 1.—Plan of a practical goat dairy.

kept it is not necessary to have much equipment, but if a considerable number of does are milked it is best to have the proper equipment for handling the work advantageously. This does not mean, however, that expensive buildings must be provided. Any clean, dry quarters free from drafts may be used.

The essentials of a dairy are facilities for the proper handling of both the goats and the milk. This requires that the building have proper ventilation, and an abundance of light and be so arranged that each goat can be fed and handled properly.

Figures 1, 2, and 3 illustrate a practical goat dairy and show the requirements necessary to handle a medium-sized herd satisfactorily. As will be noted in looking over this plan, there are pens in which the does may be handled together and stalls in which they can be fed individually. If the goats are provided with leather collars or neck chains, they can be tied to the mangers in the stalls by means of a

short rope or chain with a snap on the end which fastens to the ring on the collar.

At kidding time small temporary pens can easily be made by the use of hurdles and utilized as long as needed for this purpose. After the does have kidded they should be transferred to the stalls. Until the kids are at least a month old they should be fed and handled in the temporary pens.

It will be noted in the plan (fig. 1) that the milking room is separated from the main room and has a concrete floor. The walls and ceiling are plastered so that they can be kept clean by being washed with a hose. This room is equipped with a sink, milk scales, and milking stand. The milk is handled in another room, called the milk room. This room is equipped with a cooler, a sink, and a sterilizer. The grain is kept in feed bins erected at the opposite end

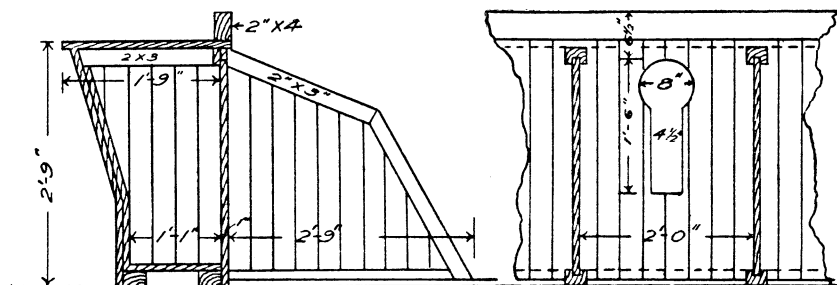


FIGURE 2.—Left, side view of single stall and manger; right, division between stall and manger. The opening allows the goat to feed and prevents the waste of feed.

of the main dairy. Space for the storage of hay can be provided either in some nearby building or in a mow above the main dairy barn.

BREEDS AND TYPES OF GOATS

Although there are many breeds and types of milk goats in the world, only a few of them have been imported into this country. This is due largely to the fact that there has been a quarantine against most of the countries where the milk-goat industry is one of the important phases of livestock production. It is not known just how many goats of each breed or type have been imported. Many immigrants have brought young goats in baskets with them when entering the country. Then, again, the breed or type was not stated on the records of many of the goats that have been imported.

The breeds that will be discussed in this publication are the Saanen, Toggenburg, Nubian, Alpine, Maltese, Schwartzenberg-Guggisberger, and the so-called common or American goat. Of these breeds the Saanen and Toggenburg are the most numerous in the United States at the present time. A herd of milk goats, consisting of grade and purebred animals of the Saanen and Toggenburg breeds, has been maintained for a number of years at the Animal Husbandry Experiment Station, Beltsville Research Center, Beltsville, Md.

The Bureau's initial work in milk-goat investigation began with the breeding of common American does to bucks of the same type

for the purpose of developing a superior strain for milk production. Progress was difficult and slow, and purebred bucks of the Saanen and Toggenburg breeds were obtained for use in grading up the herd to these two breeds. Both breeds have been kept separate and distinct from the beginning, no cross-breeding having been practiced. From the beginning the herd has been continuously improved by the use of the best purebred bucks available, the retention of the does that were the best from the standpoint of milk production, and the occasional introduction of purebred does from other herds. Records have shown that as a result of the grading-up program the average length of lactation of the grade does was increased 145 percent

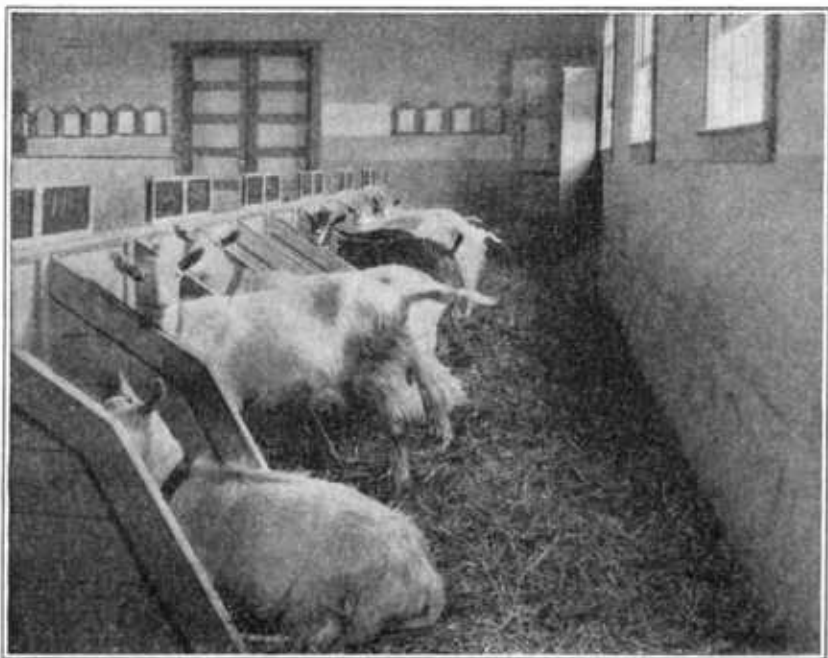


FIGURE 3.—Interior view of a dairy constructed according to the plan presented in figure 1, showing does in stalls for individual feeding.

and the average annual milk yield 335 percent over that of the foundation animals. Both the Saanen and Toggenburg breeds have been found to be very prepotent in transmitting their color to cross-bred or grade offspring as well as in improving their conformation and mammary development.

SAANEN

The Saanen is one of the leading breeds and takes its name from the Saanen Valley of Switzerland. It is said to be the largest of all the Swiss breeds. Although the Saanen is considered a hornless breed, occasionally an animal is found with horns. The color ranges from a pure to a creamy white. The dairy conformation is especially well developed. The hair is usually short, with the exception of a strip along the spinal column extending to the flanks and the hind

quarters. A Saanen buck is shown in figure 4, and does of this breed are shown on the front cover.

The first record of the importation of this breed is in 1904, when 10 head came in through the Canadian quarantine. These goats were selected in Switzerland by F. S. Peer, and were imported for other persons. R. N. Riddle, of New Jersey, imported 20 in 1905. An importation of 19 was made in 1906 by Fred Stucker, of Ohio. More recent Saanen importations of note are those by A. B. DeHaan, of Iowa, in February 1920; Mrs. A. L. Bowman, of Vermont, in May 1920; J. C. Darst, of Ohio, in August 1920, and Mr. Dewoyno, of Ohio, in January 1922.

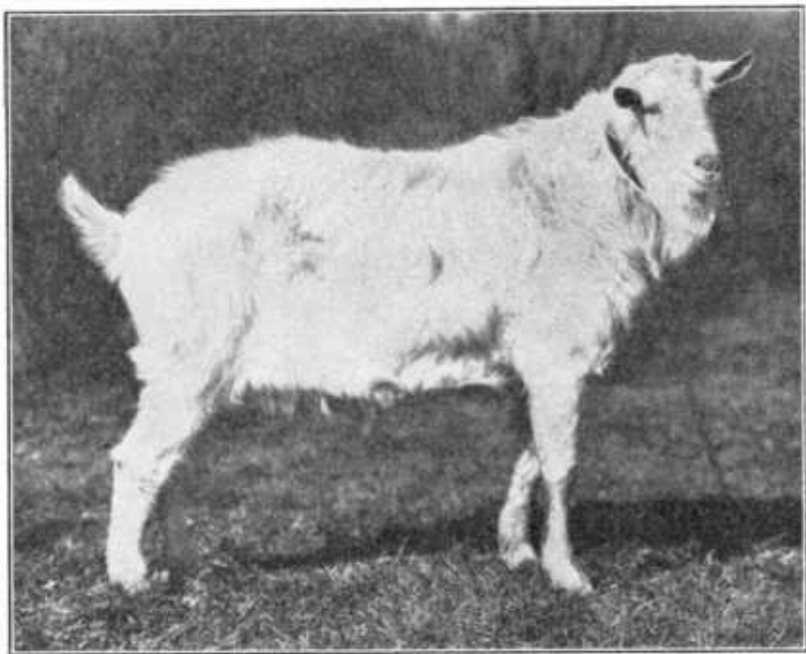


FIGURE 4.—Purebred Saanen buck, Venice Dayvern 35430, used in the Bureau's herd at Beltsville, Md. Weight, when mature, 221 pounds.

Records of the Bureau's herd show that the Saanen grade and purebred does have been milked from 8 to 10 months after kidding and have produced an average of 5.6 pounds of milk a day. Some of the best does averaged 6.5 pounds a day for 10 months. The butterfat in the milk has averaged approximately 3.5 percent.

Authentic records of high-grade and purebred does show this breed to be one of the highest producers of milk and butterfat. A grade doe in the Bureau's herd has produced as much as 12.7 pounds of milk in 24 hours, and an official record of 20 pounds and 11 ounces has been made by a purebred doe in California. The highest producers in the Bureau's herd gave from 8 to 12 pounds daily during the best period of lactation. The seven-eighths purebred doe shown in figure 5 produced 1,796.3 pounds of milk in 266 days, while a purebred doe produced 2,297.2 pounds of milk in 312 days, when given only regular-herd feed and attention.

A purebred Saanen doe on official test in California produced 4,161.7 pounds of milk in 9 months and 10 days; this is the highest official test on record in the United States for this breed.

The average weight of mature Saanen does in the Bureau's herd during a 3-year period was 120 pounds. This weight is an average of monthly weights taken during the entire periods of lactation.

The Saanen is without question one of the most beautiful and valuable breeds, and since the supply of purebreds is somewhat limited

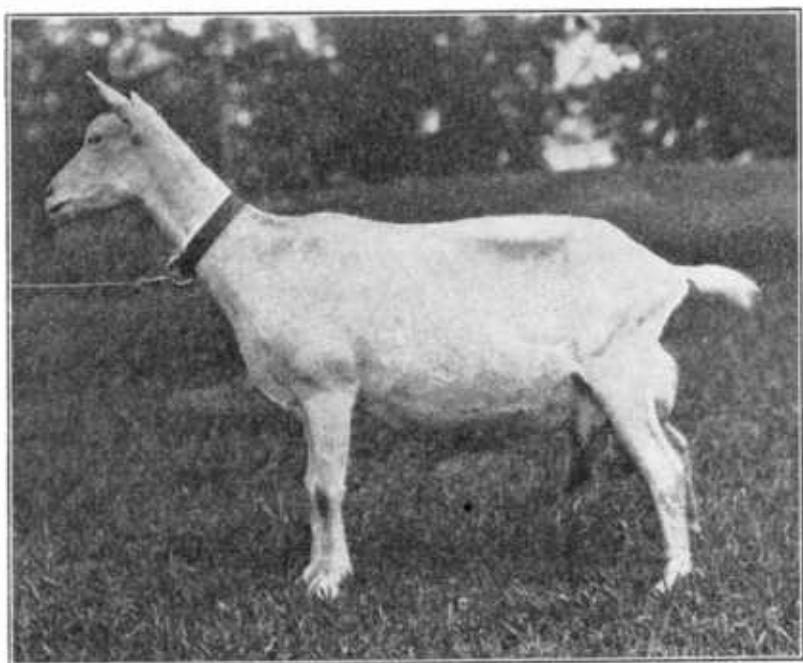


FIGURE 5.—Seven-eighths purebred Saanen doe bred in the Bureau's herd at Beltsville, Md.

in this country, it has been necessary for many producers to grade up herds of common or grade does by using purebred Saanen bucks. Bucks of this breed have proved satisfactory for this purpose.

TOGGENBURG

The Toggenburg (figs. 6 and 7) is one of the leading breeds of Switzerland and takes its name from the Toggenburg Valley, where they have been bred for a great many years. Although this is generally considered a hornless breed, occasionally a goat with horns is found. F. S. Peer, after a trip in the Toggenburg Valley, stated that he did not see a specimen with horns, no doubt because of the prevailing local custom of weeding out those that developed horns. The color of the Toggenburg is brown or chocolate with a light stripe or bar down each side of the face. The legs below the knees and hocks are light gray or almost white. The wattles or appendages, two in number, attached to the under side of the neck, are very characteristic of this breed.

There are really two types of the Toggenburg, the short-haired and the long-haired. Mr. Peer stated after visiting the Toggenburg Valley in 1904, that he was not able to get a positive answer that one type was any hardier than the other.

The first recorded importation of the Toggenburg into the United States was in 1893, when W. A. Shafor, of Hamilton, Ohio, imported four from England. In 1904 F. S. Peer imported from Switzerland for other persons 16, which later became widely distributed. One of the largest importations of milk goats ever made to this country was in 1905, when R. N. Riddle, of New Jersey, imported 119 Toggen-

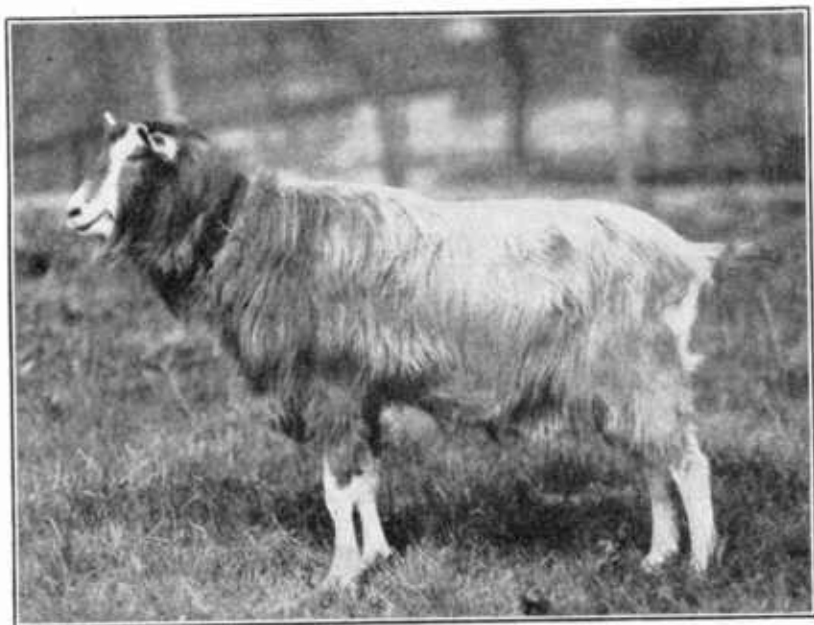


FIGURE 6.—Purebred Toggenburg buck Ace's Ne Plus Ultra 16483, used in the Bureau's herd at Beltsville. Mature weight, 175 pounds.

burgs. These goats were sold over a wide territory. Another importation of nine was made in 1905 by F. S. Peer. In 1906 Fred Stucker imported 13.

Other Toggenburg importations of note were those by A. B. DeHaan, of Iowa, in February 1920; Mrs. A. L. Bowman, of Vermont, in May 1920; J. C. Darst, of Ohio, in August 1920; and H. S. Greims, of New Jersey, in September 1934.

The Toggenburg is the most numerous as well as the most popular of the breeds of milk goats in this country. For that reason more has been heard about it and more data are available concerning it than about any other. It is said that in Switzerland Toggenburg does produce from 5 to 6 quarts of milk a day, and some of the best even more. Reliable breeders in the United States report does that produce from 4 to 6 quarts a day during the best period of lactation, and a few does have averaged from 4 to 5 quarts for a period of from 8 to 10 months.

A purebred doe in California is credited with the production of 4,348 pounds of milk in 21 months of continuous milking. Another

doe of this breed has made an official record of 3,726.7 pounds in 10 months.

Records kept on the Bureau's herd show that the grade and purebred Toggenburg does have milked from 7 to 10 months after kidding and produced an average of 4.1 pounds of milk a day. Some of the better does have averaged 5.5 pounds a day for 10 months, while one seven-eighths purebred doe produced 1,789.9 pounds of milk in one lactation period of 10 months. In the past few years the butterfat content in the milk has averaged slightly more than 3 percent.

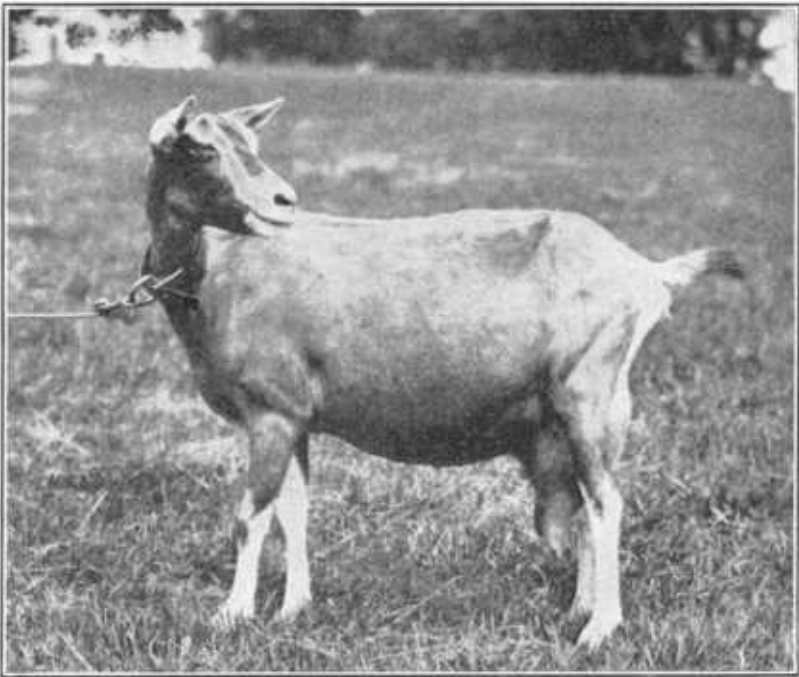


FIGURE 7.—A three-fourths purebred Toggenburg doe bred in the Bureau's herd at Beltsville, Md.

The average weight of the mature grade and purebred Toggenburg does in the Bureau's herd during a 3-year period was 96 pounds. This weight is an average of monthly weights taken during the entire periods of lactation.

Owing to the fact that Toggenburg goats are more plentiful in this country than other breeds, a good many grade goats of the Toggenburg type are found. In fact, many herds have been established by crossing Toggenburg bucks on does of the American type, and the Toggenburgs have been prepotent in transmitting their characteristics to their offspring.

NUBIAN

The Nubian, although considered a valuable breed, is found in but small numbers in this country. It is a native of Nubia, upper Egypt, and Ethiopia. Its important peculiarities consist in the length of

the large drooping ears and the shape of the head (fig. 8). The outline of the face is convex, the forehead being especially prominent; there is a depression at the nostrils; and the lower jaw projects slightly beyond the upper. The ears are wide throughout the lower extremity and of such length that they hang below the jaw and turn slightly upward at the ends. The Nubian is considered a hornless breed, but bucks occasionally develop horns. It is one of the largest breeds of goats. The hair is short and fine, and owing to this condition the breed is less hardy than the leading European

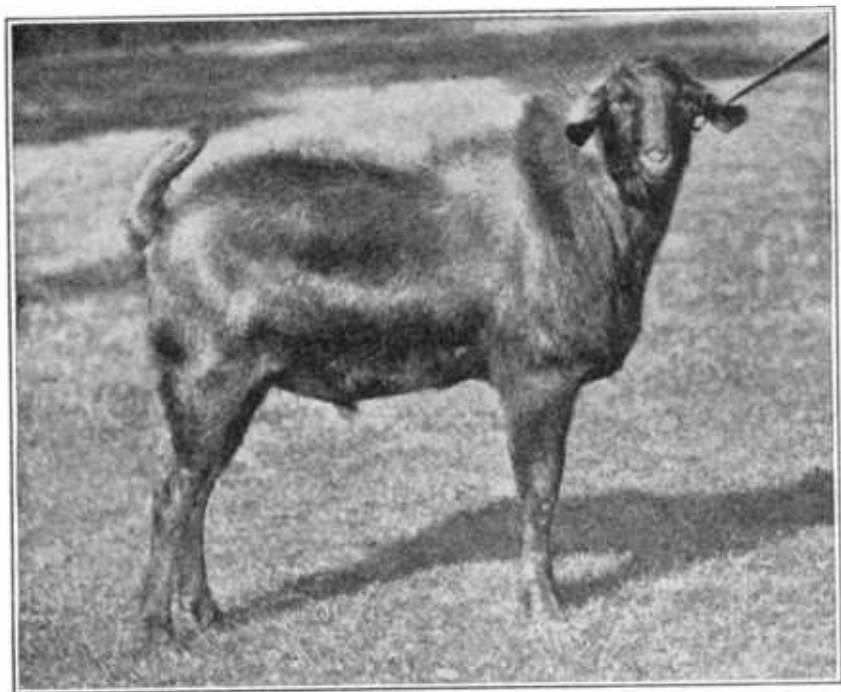


FIGURE 8.—Nubian buck.

breeds and cannot stand extreme cold. The color is black, dark brown, or tan, with or without white markings. Purebred Nubian bucks are said to be free, or nearly so, of the odor so prevalent in the males of other breeds.

The Nubian breed is very prolific and one of the best for milk production, the milk testing especially high in butterfat. Nubian bucks have been crossed on common does with very satisfactory results.

An importation of four Nubians was made to this country from Mexico by W. W. Carr, of Virginia, in 1909. These goats came to Mexico from France.

The Anglo-Nubian, which is a very popular type of goat in England and is found in many sections of the United States, is a cross between the Nubian or Indian goats and the native English goat. These goats are good milk producers. There is no special fixed color; black, tan, and red, with or without white, predominate. Occasionally some goats are found that are either spotted or piebald. All goats of Nubian breeding have similar characteristics.

In 1896 G. Howard Davison, of New York, imported four English goats. It is very probable that they were of the Anglo-Nubian type. In 1909, four Anglo-Nubians were imported from England by R. I. Gregg, who also imported two from England in 1913. In 1906 D. C. Mayers, of Virginia, imported seven grade goats from Barbados. Some of these goats were of Nubian breeding.

The Bureau has never experimented with milking does of Nubian breeding, and so cannot give results such as are mentioned for some of the other breeds.

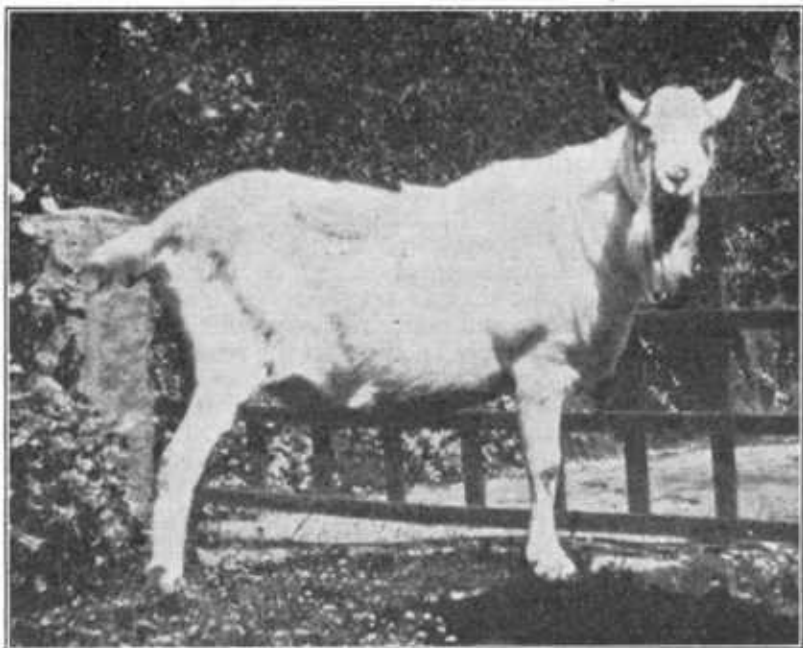


FIGURE 9.—Purebred Alpine buck, Le Pöllu 15616.

ALPINE

The Alpine is one of the most recently imported breeds and has gained rapidly both in numbers and in general popularity in the past decade. This breed is one of the largest, is quite hardy, and shows great capacity for milk production. The animals are alert in appearance, more closely resembling the Saanen in general conformation than any of the other more prominent breeds. The color ranges from pure white to pure black although some white spotting is usually present, generally on the neck, legs, or underneath the body.

There is often a mixture of white and dark hair forming dark markings of bluish gray or brownish gray in combination with pure white.

This breed was developed in the mountains of France and has been selected for heavy milk production for generations. It is comparatively heavy of bone and presents a general appearance of ruggedness (fig. 9) that is partly responsible for the great popularity the breed enjoys.

All purebred Alpines in the United States trace directly to the original importation selected by Charles DeLangle in France. This importation, which arrived in California in 1922, consisted of 3 bucks and 18 does which were especially selected for heavy milk-producing inheritance. It is reported that animals of this breed are very prepotent and have been crossed with grade goats and other purebreds with good results. They are usually hornless, but horns occur more often than in some of the other breeds.

LESS IMPORTANT TYPES AND BREEDS

MALTESE

Although considered a valuable breed of milk goat, the Maltese is of no special importance in this country, except that it has had some influence on the type of goats in the Southwest. As the name signifies, it is a native of the island of Malta.

This breed is kept in large numbers on that island. It is usually hornless, but occasionally an animal has horns. The ears are rather long and are carried horizontally. The udders are rather large and in many instances almost touch the ground. For milk production this breed is considered quite satisfactory. The hair is rather long, the color being white and reddish brown or black.

For a number of years there has been in the southwestern part of the United States a type of goats known as the Spanish Maltese. It is said that at a former time many Maltese goats were taken into Spain and later found their way to Mexico and finally to Texas and New Mexico. This type of goats is white or grayish in color, but many have brown, bluish-black, or reddish spots. The ears are pendulous. No reliable information is at hand regarding milk production, although it is asserted that some are very good producers.

SCHWARTZENBERG-GUGGISBERGER

The Schwartzenberg-Guggisberger breed came originally from the Simmen Valley, Switzerland. Although it is represented in the United States in only very small numbers, it may prove to be valuable if a sufficient number can be developed to give it a thorough trial.

Not only is this breed of good size, but the does show a very good dairy conformation. Hilpert describes it as being built like the Saanen and as fawn color or brownish white and very large sized. He also says that it is excelled by no other breed of goats in milk production when under good care and feed. A purebred doe at the New York Experiment Station produced an average of 730.8 pounds of milk a year for 3 years. The same doe produced 913.3 pounds in 1 year.

An importation of three of these goats was made in 1906 by Fred Stucker, of Ohio.

COMMON, OR AMERICAN

Either of the names "common" or "American" may be applied to a large number of short-haired goats found in many sections of the United States, especially in the South. In many sections these goats have been bred for a great many years without the introduction of

outside blood, so that in general conformation they are very nearly uniform.

They are of medium size and are somewhat short legged (fig. 10), rather meaty in appearance, and do not show the conformation of the Swiss breeds. Although occasionally a few goats of this type are found that are good milkers, the quantity of milk produced is usually small, and the lactation period lasts only a few months. One of the greatest objections from the standpoint of utilizing this type of goat for milking is the fact that the teats are usually short and small. Both sexes as a rule have horns, those on the bucks frequently attain-

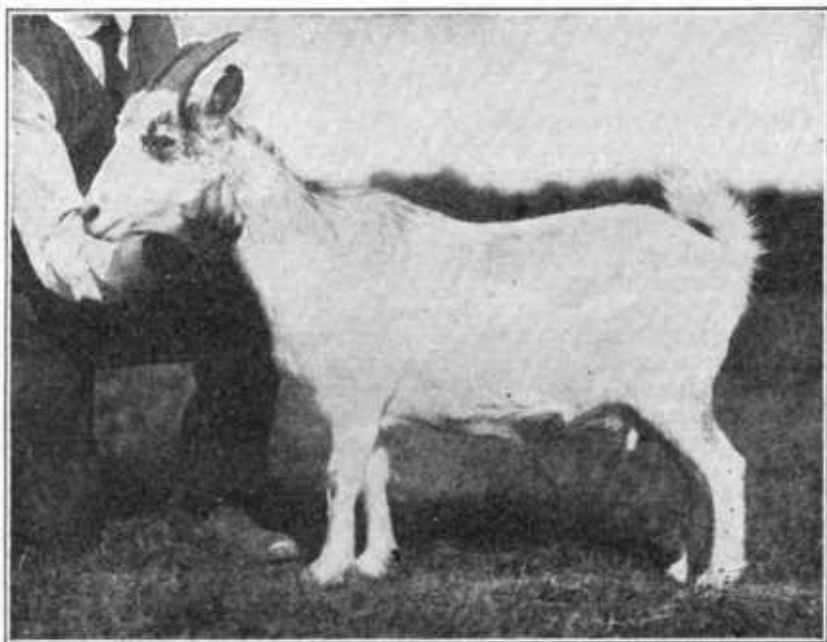


FIGURE 10.—Common American doe of the type used as the foundation of the grade herd at Beltsville, Md.

ing a good size. This type of goat is of various colors; brown of various shades, brown and white, black and white, bluish gray, and white predominate.

The Bureau of Animal Industry selected a shipment of common short-haired goats in the South in 1909 for the purpose of testing them for their milk production. It was found that the does not only produced a rather small quantity of milk, but the average lactation period was short. In 1915, 10 of the best selected does produced milk for periods of from 7 to 10 months and gave from 1 to 2 pounds of milk a day. The average production for the 10 does was $1\frac{1}{2}$ pounds. The percent of butterfat ranged from 6.5 to 9.4, the average being 7.6 percent.

These goats are very prolific. In 1912 the rate of increase was a little over 250 percent, and for a period of several years it was 225 percent.

Owing to the scarcity of good milk goats, the common or American type properly selected offers a good foundation for grading up with the Toggenburg, Saanen, Nubian, or Alpine breed.

Since it would require many years to build up a good milking type by the use of the common goats alone, and such excellent results were obtained by crossing Saanen and Toggenburg bucks on them, the Bureau discontinued the use of common goats in 1913.

Large numbers of goats have been brought in from Mexico, and no doubt they have had some influence on the type found in many parts of the South and Southwest. These Mexican goats, in many cases, show considerable influence of the imported Spanish types.

METHODS OF BREEDING

SELECTION OF THE BUCK

The buck is always considered half the herd, and, in order to make progress in breeding, care should be exercised in making this selection. As good bucks are scarce, it is not always possible to get the type desired, but the best obtainable should be procured even if the cost is a little greater. Select a buck from a good-producing doe and a persistent milker. There is nothing more important in the matter of breeding than evidence that the entire family to which the sire belongs is especially good in performance and in conformation. The success of breeding any class of animals depends largely on the selection of the sires. The selection of a single sire has made many herds famous.

A buck should be masculine in appearance, of at least medium size for his age, and of good conformation. As regards the latter, a good depth of body is one of the most important considerations. The masculinity of the buck can be determined, of course, by the size and conformation of the head, size of the legs, amount of beard, and the quality and length of the hair on various portions of the body. The legs should be straight and well-placed. Always select a vigorous buck. Thinness is no objection if the buck is healthy and a good feeder. A good buck is seldom in good flesh, especially during the breeding season.

Most breeders at the present time prefer bucks that are naturally hornless. Such bucks are usually prepotent and most of their kids are without horns. The class of does to which the buck is bred will, of course, have some influence in this respect.

When only a few does are kept, it would be not only cheaper but more convenient to send them away to be bred. A buck is usually a troublesome individual, and must be kept away from the rest of the herd. Many of the leading breeders breed outside does, and the charges made are usually very reasonable.

Many small breeders are compelled to use cross-bred or grade bucks; in such cases selections should be made upon conformation and breeding, and such a method should be employed only when satisfactory, purebred-buck service is not available.

SELECTION OF THE DOE

Although it is not always possible, it is much more satisfactory in making selections to see does during their lactation period. This not only gives an opportunity to study their conformation when they

are producing, but the udder development, which is so important, can be better observed.

A good doe should have a feminine head, thin neck, sharp withers, well-defined spine and hips, thin thighs, and rather fine bone. The skin should be fine and thin over the ribs. She should have good digestive capacity, as shown by the spring of rib and size of stomach. The so-called wedge shape of the dairy cow is clearly defined in a good milk doe. The constitution, an important item, is indicated by the depth and width of the chest. The udder should be of good size when filled with milk and very much reduced when empty. A large udder does not always indicate a high milk yield unless it is of the so-called "genuine" type. The teats should be large enough to make milking easy.

In selecting a doe the first questions that are naturally asked are: How much milk will she produce and how long will she milk? While some does milk for only a few months after kidding, others continue producing for 8 to 10 months or even longer.

In selecting does, especially when they are giving milk, avoid those that are fleshy; this is a strong indication that they are not good producers. Select those of the dairy conformation.

Owing to the scarcity of good does, both grades and purebreds, and the prices asked for them, it is much more economical to begin a herd by selecting good, common does, such as are found in many sections of the country, and breeding them to bucks of the leading breeds.

AGE FOR BREEDING

Goats are in their prime when from 4 to 6 years of age, but choice individuals and good breeders may often be kept to advantage several years longer. As a general rule young does should not be bred until they are from 15 to 18 months of age, at which time they will be practically grown if they have been well cared for. As most breeders have their does kid in the months of February, March, and April, and breed them but once a year, it means that the doe kids dropped during these months should be bred the second fall after birth. Owing to the fact, however, that some people who keep only two or three does desire a milk supply during the entire year, it would be necessary to breed for both fall and spring kidding. The same would be true where goat dairies are operated. In such cases young does, well grown, can be bred to advantage when from 12 to 15 months of age.

Does breed when young, and care should be taken not to allow them to become pregnant too young. Cases are recorded in which does have kidded when less than 9 months of age.

PERIODS OF HEAT

Does come in heat regularly between September and March, after which only an occasional doe can be bred until late in August, when the entire herd will come in heat again. When they come in heat and desire the attention of the buck they make their condition known by uneasiness and constant shaking of the tail. They usually remain in heat from 1 to 2 days. The period between heats varies from 5 to 21 days. From the record kept of the Bureau's herd, more does have returned in from 17 to 21 days, but it is not unusual for them to

return in from 5 to 7 days after service. Bucks are continually of use for service from the fall to the spring season. It is during this time that they have such a strong odor. The number of does to breed to one buck depends on his age and condition. An early spring buck kid, if well grown and properly handled, can be bred to a few does the following fall. A buck from 12 to 18 months of age can be bred to at least 25 does, and a mature buck is sufficient for from 40 to 50 does.

GESTATION PERIOD

The gestation period, which is the time between the effective service of the buck and the birth of the kid or kids, ranges from 146 to 152 days. It is usually spoken of as 5 months. The average gestation period recorded for several years in the Bureau's herd with does of several different crosses bred to Saanen and Toggenburg bucks has been 149 days.

NUMBER OF KIDS

Milk goats are very prolific. The usual number of kids at one time for mature does is two, but frequently there are three, and it is not a rare thing, especially among the common American goats, to have a doe produce four. The average kidding percent has been only slightly different in the Saanen and Toggenburg breeds. Yearling Saanen does have produced kids at a rate of 166 per 100 does, as compared with 168 per 100 for the Toggenburgs, while the mature Saanen does have produced kids at a rate of 202 per 100, as compared with 196 per 100 mature Toggenburg does.

FEED AND MANAGEMENT

THE BUCK

In handling goats the buck problem is one of considerable importance. It is the strong odor and the disgusting habits of the bucks that cause many people to take a great dislike to goats. Bucks should be kept away from the does except when desired for service. If they are kept in the same barn or room where the does are milked, some of the strong odor is very likely to be absorbed by the milk. The place for the bucks is in a separate barn or shed, with a sufficient lot for exercise and pasture.

The best results can be expected only when the bucks are kept in a healthy condition. During the winter months the ration should consist of alfalfa, clover, or mixed hay and corn stover, with some succulent feed in the way of silage, turnips, etc., and a sufficient quantity of grain.

For several seasons the bucks in the Bureau's herd have been wintered on 3 pounds of alfalfa or clover hay, 1 to 1½ pounds of silage and 1½ pounds of grain a day, the grain mixture consisting of 100 pounds of corn, 100 pounds of oats, 50 pounds of bran, and 25 pounds of linseed meal. During the breeding season the grain ration for mature bucks is usually increased to 2 pounds. When the bucks are out on good pasture, no grain is necessary.

During the breeding season it is usually necessary to keep the bucks separate, or they will fight and are likely to injure one another.

A wood lot with plenty of browse is an excellent place for the bucks during the summer. It must be noted that goats are browsers by nature and they prefer leaves, twigs, and weeds to grass.

Under the conditions which many people keep goats it is necessary to protect the trees in the lots and pastures by putting around them a framework covered with close-woven wire. This is true especially of the young trees. If no lot is available for feed and exercise, the buck may be tethered out. This system is practiced by many people who have only a small lot. Vacant lots can very often be utilized to advantage for this purpose. Fresh feed as well as a variety is thus afforded.

THE DOES

Most of the feeds that are valuable for the production of milk for the dairy cow are also suitable for does. It is ordinarily considered that from six to eight goats can be kept upon the feed required for one cow. When does are in milk, they should be allowed all the roughage that they will consume, such as alfalfa, clover, or mixed hay and corn stover. They should receive a liberal quantity of succulent feed, such as silage, mangel-wurzels, carrots, rutabagas, parsnips, or turnips. The grain feeds best suited for their ration are corn, oats, bran, barley, and linseed meal or linseed cake. Other feeds that are often available and that can be utilized are cottonseed meal, brewers' grains, corn bran, gluten feed, and beet pulp.

A ration that has been used in the Bureau's herd and has proved to be very satisfactory for does in milk during the winter season consists of 2 pounds of alfalfa or clover hay, $1\frac{1}{2}$ pounds of corn silage or roots, and from 1 to 2 pounds of grain. The grain ration consists of a mixture of 100 pounds of corn, 100 pounds of oats, 50 pounds of bran, and 25 pounds of linseed meal. When the does are on pasture they receive from 1 to $1\frac{1}{2}$ pounds of grain per day of the mixture mentioned.

However, there is a great difference in individual goats; one goat may readily eat a ration that another may not like so well. As in the case of dairy cows, each doe should be studied if the best results are to be obtained. It is best, of course, to feed separately each doe that is giving milk. This not only affords an opportunity to study each individual but also insures that each one receives the quantity intended for her.

In 1931 the Bureau's herd of both grade and purebred Saanen and Toggenburg does required an average of 1.0 pound of grain to produce a quart of milk, on the basis of the daily consumption of grain throughout the entire periods of lactation. It is safe to figure on 500 pounds of hay and 450 pounds of grain a year for a mature doe, providing, of course, that good pasture is afforded as much of the year as possible. Estimated annual feed costs for does in the Bureau's herd during the years 1930-1935 ranged from \$10 to \$15 per doe. During the year 1935 the feed cost per doe was approximately \$11.50, and the average feed cost per gallon of milk was 6.9 cents, on the basis of average prices of feed for the United States in that year. These costs agree closely with those reported in Bulletin 429, of the New York Agricultural Experiment Station, and in Bulletin 285, of the California Agricultural Experiment Station.

Young does should be kept growing, and the quantity of feed needed will depend upon certain conditions. In the spring, summer, and fall, if they have plenty of browse and pasture, no grain is necessary. If no browse is afforded and the pasture is short during certain months, it is best to give them a little grain. In winter they should be fed about 1 pound of grain, 1 to 1½ pounds of silage or roots, and all the hay or fodder they will consume. They should have a shed for shelter and protection from the wind. Goats must be kept dry and out of cold winds.

Some goat breeders make it a practice to gather leaves in the fall and store them for winter use. This practice should be resorted to only in cases of shortage of more desirable feed. Leaves may be used for bedding, but even for this purpose they are only fairly satisfactory. If only 1 or 2 goats are kept, refuse from the kitchen, such as potato and turnip peelings, cabbage leaves, and waste bread may be utilized for feeding. If necessary, does may be tethered out, as described in connection with handling the buck.

All feed offered to goats should be clean. Rations should be made up from the best feeds available and those most relished by the goats. Plenty of rock salt should be kept before the goats, and a small quantity of fine salt should occasionally be mixed with the grain fed. A good supply of fresh water is necessary; goats should not be compelled to drink from pools where the water has been standing.

LACTATION PERIOD

The lactation period, which is the time that a doe produces milk, varies considerably in the different breeds and types of goats. It ranges all the way from 3 to 10 months, or even longer. A lactation period ranging from 7 to 10 months is considered very satisfactory. There are certain conditions, such as the breed, individuality, health, feed, and regularity and thoroughness of milking, which may influence it. Purebred does of any of the leading breeds, as a general rule, will milk longer than any of the so-called common, or American type. The breed that has been developed the longest should, of course, excel in this respect if the animals have been properly selected. There are always individuals in a breed that excel along certain lines, and this is especially true as regards length of lactation period.

The health of the does while giving milk is of special importance. When does are out of condition frequently their milk yield shrinks, and in many cases, they have to be dried up. Proper feed and regular feeding have a tendency to extend the lactation period not only by stimulating the production but by causing a more uniform flow during this time. The milking must be done regularly and thoroughly if good results are desired. Irregularity and neglecting to draw all the milk from the udder have a tendency to shorten the period.

MILKING

As goats are small animals, they can be milked to much better advantage when on a stand such as that shown in figure 11. As young does usually object at first to being milked, the stanchion arrangement shown in the illustration is an excellent method of

handling them. For the first few times at least it is best to give the doe a little grain feed in the box attached to the stanchion. Does soon become accustomed to being milked and after a few times will jump up on the stand and put their heads through the stanchion without being assisted.

The doe's udder should always be either washed or wiped thoroughly before being milked. Ordinarily a damp cloth is sufficient to remove all foreign material. The first milk drawn should not be saved, as the openings in the teats may be partially filled with foreign matter which will be removed after a little milk has been drawn.

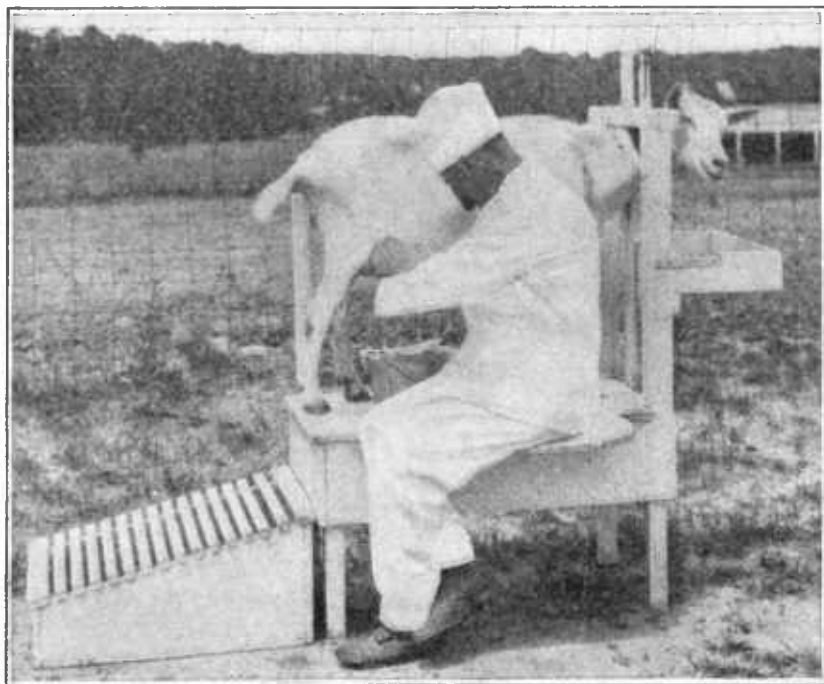


FIGURE 11.—Milking stand and method of milking in the herd of the Bureau of Animal Industry, Beltsville, Md.

It is best to have a room for milking separate from the main goat barn. This prevents the milk from absorbing any odors that may be present in the stable.

There are two systems of milking goats, one when the milking is performed from the side, as is practiced in milking cows, and the other when it is performed from the rear of the goat (fig. 12). Either method is satisfactory, but milking from the rear is probably more convenient when does are not removed from the stable for milking. All the does in the Bureau's herd are milked on a milking stand in a room separated by a closed door from any compartment of the building used as a stable.

There are also two systems of drawing the milk from the udder—one consists in pressing the teat in the hand, as is usually practiced in milking cows, and the other in "stripping." The first can be

adopted when the teats are of sufficient size to be grasped by the hand. The other method is followed by most goat milkers and is a very satisfactory way. The teat is grasped between the first finger and the thumb close to the udder and drawn down the entire length, sufficient pressure being exerted to cause the milk to flow freely.

A heavy producer may have to be milked three times a day for a short time, but twice is sufficient for most does. The period between milkings should be divided up as equally as possible. Milk should not be used for human consumption until the fourth or fifth day after the doe kids. Some authorities recommend waiting for a longer period, but this is not necessary if everything is normal. Regularity in milking is important, and kindness and gentleness should be regarded as essential in the goat dairy. It is advisable that the milking be done by the same person as much as possible.



FIGURE 12.—A Pennsylvania goat dairy, showing method of milking.

In some of the European countries goats are driven through the streets from door to door, and the milk is drawn by the goatherd as ordered by the customers.

CARE OF THE MILK

All utensils used in handling the milk should be kept clean. A covered milking pail (fig. 13) should be used, and as soon as the milk is drawn it should be weighed, strained, and cooled. The weighing is necessary if it is desired to determine accurately how much the doe produces. Milk records are especially valuable to the breeder in selling stock as well as in his breeding operations.

The milk should always be thoroughly strained to remove any foreign matter. The best method is to use a layer of sterilized absorbent cotton between two cloths, or to pass the milk through several thicknesses of cloth. Cheese cloth is the best for this purpose.

To check the growth of bacteria the milk should be cooled to a temperature of 50° F. as soon after milking as possible. This may

be done by placing the cans in a tank containing cold water. One of the best systems of cooling the milk rapidly, however, is to run it over a cooler inside of which is cold, running water. Milk should be kept cool until wanted for use. Complete information on the production of clean milk is contained in Farmers' Bulletin 602.

RAISING THE KIDS

The raising of the kids is especially an important consideration when it is desired either to sell or use the milk for family purposes (fig. 14).



FIGURE 13.—Milking pail suitable for a goat dairy. The pail has a capacity of 4 quarts.

Those, however, who do not care to raise the kids can easily dispose of them when a few days old. Kids that are allowed to suckle their dams not only make a good growth but require very little attention as compared with those raised by hand.

The quantity of milk to be fed and the length of time that it should be fed depends on several conditions. Kids dropped in the spring do not require so much milk and need not be fed so long as those dropped in the fall or early in winter. The quantity of milk required for a kid can be determined readily from the fact that a doe producing from 3 to 4 pounds of milk a day can easily raise two kids very satisfactorily. This means that each kid would receive $1\frac{1}{2}$ to 2 pounds of milk a day, or, in other words, $1\frac{1}{2}$ to 2 pints. The Bureau has conducted an experiment in allowing several does with records of a little above 4 pounds of milk a day to suckle three kids. The kids made a fairly good growth, which shows that when some hay and grain is added it does not require so much milk as might be supposed.

Studies in the feeding of kids by hand in the Bureau's herd have shown that after they have reached 10 weeks of age the milk may be replaced in a large measure by good alfalfa hay and mixed grain

without sacrificing body weight and development. During the period from 10 to 18 weeks of age one lot of kids were given 60 pounds less milk than the check lot, and all were fed all the hay and grain they would clean up. The results showed that the kids on the restricted milk diet consumed an average of 9 pounds more grain and 2 pounds more hay during this period of 8 weeks than the check lot to replace the 60 pounds reduction in the milk diet. The average weight of the kids in the two lots was identical at the close of the feeding test. This substitution of grain and hay for milk in kid feeding is economical, as our records show that it takes approximately 1 pound of grain to produce 2.2 pounds of milk.

Kids to be raised by hand should not be allowed to nurse the doe. They should, however, be given the colostrum milk which is so valuable to them during the 2 days following birth.



FIGURE 14.—Half-blood and three-quarter-blood Saanen kids.

Kids can be raised satisfactorily on whole cow's milk, and some goat breeders have adopted a system whereby skim milk has been used with a fair degree of success. The kids should be changed from whole to skim milk very gradually, the quantity of skim milk being gradually increased until it makes up the entire milk ration. After this has been done the kids will usually consume from 2 to 3 pounds a day. They should be given just as much as they will drink readily, and until they are at least 6 weeks old they should be fed three times a day. During this time the milk should be warmed and fed at a temperature ranging from 90° F. to not more than 98° F. The kids can be weaned from milk when they are from 3 to 4 months old. At about 8 weeks of age the digestive system of kids is usually sufficiently developed so that they can obtain substantial nourishment from solid feeds. At weaning age they will consume sufficient hay, grain, and pasture to make a good growth. Some of the leading goat breeders do not wean the kids until they are about 5 months of age. The age for weaning, however, should depend upon the system of raising the kids. If raised by nursing the does, they can be allowed to remain in the herd until 5 months of age; but if they are raised by hand feeding and the supply of milk is limited, they may be weaned much earlier without serious results.

Kids will eat a little hay and grain at an early age, and they should be provided with them. Alfalfa or clover hay should be given in a rack and the grain mixture in a trough. Arrangements should be made to keep the kids out of both the rack and the trough. A good grain ration for the kids consists of cracked corn, crushed or rolled oats, and bran mixed in the proportion of one part cracked corn, one part crushed or rolled oats, and one-half part bran. They should be allowed as much as they will clean up during the 24-hour period until they are eating one-half pound a day. All grain that is not eaten should be removed from the trough each day and fresh grain provided, as kids are very delicate in their eating habits.



FIGURE 15.—Feeding a kid individually with milk from a pan.

If the kids are fed by hand, they can either be given the milk from a bottle with a nipple or a tank with a number of nipples attached, or they may be fed from pans (fig. 15). The Bureau has used both the pan-and-trough and bottle-and-nipple methods in raising kids. Most kids can easily be taught to drink from a pan or trough, and this system is less troublesome. Some kids, however, are very slow in learning to drink and do much better when fed from a bottle. Cleanliness is absolutely essential for the successful raising of kids. The pans, pails, bottles, and nipples should be kept clean. After the kids are a few weeks old and have learned to drink, they can be fed from a galvanized-iron trough. Care should be taken, however, to see that each kid receives its share of the milk.

Kids are very playful creatures and require considerable exercise. If they are kept in a small enclosure, it is a good plan to put a box from 18 to 20 inches in height in the center, so that they may run and jump upon it. This will not only afford them considerable amusement but will give them plenty of exercise, and they will have

keen appetites for their feed. Pasture or browse should be afforded as early as possible.

CASTRATION

All buck kids not desired to be kept or sold for breeding purposes should be castrated when they are from 10 days to 3 weeks of age. The older they are, the more severe the operation. The operation of castration is very simple and can be performed best by cutting off the lower third of the scrotum with a clean, sharp knife, forcing the testicles down and pulling them away, one at a time, with the spermatic cords attached. If, however, the kids are more than 4 months of age, the cords should not be pulled out but scraped off just above the testicles. The wound should be bathed with some good disinfectant after the operation.

Buck kids should be separated from the doe kids when they are about 4 months of age. Doe kids come in heat when young, and the young bucks worry them a great deal if allowed to run with them. Occasionally doe kids become pregnant when they are only from 4 to 5 months of age.

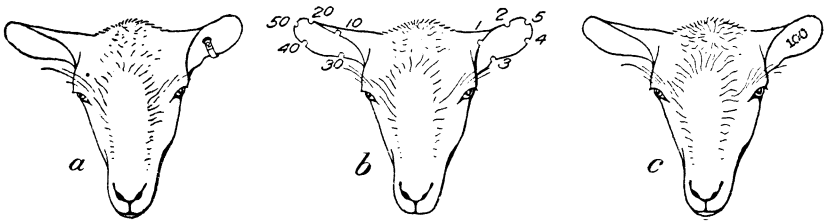


FIGURE 16.—Methods of marking goats' ears: *a*, Metal label; *b*, notching; *c*, tattooing.

MARKING

Each goat in the herd should be marked in some manner for identification. This may be done by the use of metal ear labels, by notching the ears, or by tattooing the ears (fig. 16). In some instances all three of these systems are used. When this is done, the kids' ears are notched as soon after birth as possible, and when they are from 3 to 6 months of age the ear label is inserted and the tattooing done. The ear label is only a fairly satisfactory method of marking and never should be used as a sole means of identification as it is liable to be torn out. Care should always be taken to insert the label rather close to the head and far enough up into the ear to make it fairly tight.

Notching the ears can be done with the punch used for inserting the ear label. Notches on certain parts of the ears indicate certain numbers, the sum of the numbers represented by the notches being the number of the goat. Numbers up into the hundreds involve a rather complicated system, but they are not usually necessary in a small herd. To avoid a complex system, each crop of kids may be numbered from one upward. The notch system is especially valuable, as it not only serves as a means of identification but it is not always necessary to catch the goats to read their numbers. A person can stand some distance from the goat, and if the goat is facing him the notches can be seen readily.

Tattooing on the inside of the ear is the most satisfactory method of marking goats. There are on the market tattooing instruments having adjustable numbers and letters, with which a combination containing three or four of either or both can be made. Some breeders tattoo their initials in one ear and a number in the other. Tattooing is an excellent method of recording the identity of goats as the numbers are easily read and when properly inserted are practically permanent. India ink, both stick and liquid, special tattooing oil, and indigo can be used for pigment.

DIPPING, DEHORNING, ETC.

When goats are infested with lice, as they sometimes are, they should be either dipped or washed. If the herd contains only a few head, it is not necessary to go to the expense of dipping, as a careful washing will gain the desired results. Any good, reliable stock dip advertised upon the market will answer the purpose. The main thing is to follow the instructions regarding the use of the dip selected. Methods of dipping sheep, as described in Farmers' Bulletin 798, *The Sheep Tick*, may also be followed for goats.

Mature goats may be dehorned safely. This is done best by sawing the horns off close to the head with a common meat saw. The operation should be performed if possible when the weather is fairly cool and when flies are not troublesome. As soon as the horns are removed it is well to apply a little pine tar to the wounds.

The horns on kids can be prevented from developing by using either caustic soda or caustic potash, which may be obtained from the drug store in the form of sticks about the thickness of a lead pencil. These caustics should be used with care, as they may injure the skin of the person handling them. The stick caustic should be wrapped in a piece of paper to protect the fingers, leaving one end uncovered. Moisten the uncovered end and rub it on the horn buttons. Care should be taken to apply the caustic to the horn button only, but it should be blistered well. This is best effected by clipping the hair close to the head for some distance around the horn button and coating the surface with petrolatum, leaving the skin close to the horn button and the button itself free from the coating.

The caustic may then be applied to the uncoated portion without danger of its burning the remainder of the head or running into the eyes. The application should be made when the kids are from 2 to 5 days old.

The best fence for enclosing goats is of woven wire (fig. 17), ranging in height from 48 to 52 inches. Care should be taken to have the ends of the braces against the end posts low enough so that the goats cannot walk up them and jump over.

If goats are more or less confined and not allowed to run upon gravelly or rocky soil their hoofs grow out and should be trimmed. This can be done with either a sharp knife or a pair of small pruning shears.

GOAT MEAT AND GOATSKINS

There has always been a rather general prejudice in this country against the use of goat meat as food. However, in some sections a great many goats of the milk type, especially kids, are consumed

annually. In some parts of the South kids are considered as a delicacy and are in demand. They are sold for slaughter when from 8 to 12 weeks of age. The flesh of young goats, or kids, is palatable and has a flavor suggesting lamb.

The prices of goats sold on the market for slaughter are always considerably less than those received for sheep. Goats do not fatten and carry flesh like sheep. Nevertheless, it is known that thousands of goats, both old and young, are slaughtered annually and their meat sold as mutton and lamb.

Owing to the fact that the United States imports in normal times upward of 60,000,000 pounds of goatskins annually, it would be sup-

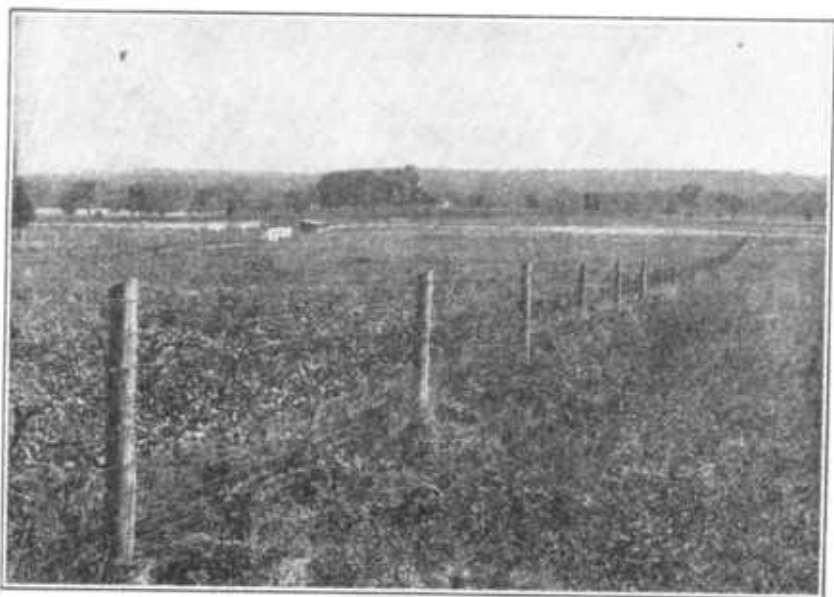


FIGURE 17.—Type of goat fence used at the Animal Husbandry Experiment Station, Beltsville, Md.; 48 inches high.

posed that there would be a ready market for all skins that could be produced. Skins from the short-haired goats, such as the common type of American goats of the milk breeds, are the kind used in the manufacture of shoes, gloves, bookbindings, pocketbooks, and like articles. As a rule goatskins from the short-haired goat are worth from 25 to 50 cents each. The price depends on the size and condition of the skin.

PRICES OF GOATS

Owing to the excellent demand and the limited supply of milk goats, breeders are naturally asking good prices for stock. Pure-bred bucks of any of the leading breeds cost \$50.00 or more, depending, of course, on the breed, age, conformation, and breeding. Good bucks from record-producing does are usually held at a higher figure. Grade or cross-bred bucks may usually be purchased for from \$10 to \$15. Bucks of such a breed as the Nubian are very scarce, and the prices asked for them are usually high.

The prices for does not only depend on the breed, age, conformation, and breeding, but on milk production. Purebred does cost from \$50 to \$100 or more, whereas grade or cross-bred does range from \$15 to \$50 and higher if they are exceptional producers. Persons who wish to procure a milking doe to furnish milk for an infant or an invalid are only too glad, as a rule, to pay a fair price and do not care so much about the breeding of the goat. It is largely milk production in the doe that establishes her value.

In some herds, where breeders do not care to raise all the kids and desire to dispose of them as soon as possible after birth, the prices range from a few dollars up to \$10 a head.

RENTING GOATS

It occasionally happens that a supply of goats' milk is desired for only a short time. Under such conditions does are sometimes rented. Sometimes a breeder would not care to sell a doe but would be willing to rent her out. The charges for this service depend not only on the value of the doe and the quantity of milk she is capable of producing, but on how badly the goat is needed. In one case on record a doe was rented for a period of 3 months at \$10 a month, and in case of the death of the doe the owner was to receive her full estimated value. However, a fair basis for the charge of renting out a doe would be a reasonable price per quart for the milk she would probably produce during the period wanted.

GOAT TROUBLES

Although considered very healthy, goats are subject to disease and have their troubles as well as any other animal. Goats are less subject to disease than sheep, but the two species are so closely allied that, in general, the treatment in cases of disease is the same for both. Since the diagnosis and treatment of diseases require special knowledge and experience, the services of a veterinarian should be obtained whenever disease problems arise.

A matter of great importance and one on which breeders lay considerable emphasis is the fact that goats are rarely affected with tuberculosis. When confined to close quarters with cows that have tuberculosis, they may, however, contract the disease. Goats that are in good condition are not very liable to be diseased or to contract disease, but there are some maladies which affect them if they are allowed to get in poor condition.

In the Federal meat inspection the cause of most of the condemnations for goats on both ante-mortem and post-mortem inspections is emaciation. Emaciation may be due to any one of a combination of several conditions or diseases, such as stomach worms, flukes, tapeworms, and abortion. It is necessary, of course, to find out the real cause of this condition before a treatment can be administered.

STOMACH WORMS

Goats become infected with stomach worms, the important symptoms of which are loss of flesh, weakness, digestive disturbances, diarrhea or constipation, capricious appetite, and paleness of the mucous membranes of the eyes and mouth. Swellings under the

jaw are often noticed. Stomach worms are found in the fourth stomach; they are rather small, ranging from $\frac{1}{2}$ to $1\frac{1}{4}$ inches in length, and about as thick as an ordinary pin.

A satisfactory treatment for the removal of the common stomach worm consists in the use of a 1-percent solution of copper sulphate. The dose of this solution is as follows: For animals 3 months old, three-fourths fluid ounce; 6 months old, $1\frac{1}{2}$ fluid ounces; 12 months old, $2\frac{1}{2}$ fluid ounces; 18 months old, 3 fluid ounces; and 24 months old, $3\frac{1}{2}$ fluid ounces.

To prepare the 1-percent copper sulphate solution, dissolve 1 ounce of freshly powdered copper sulphate in 3 quarts of warm water. The solution should be prepared in porcelain or enamelware containers as copper sulphate will corrode metal. Only clear blue crystals should be used for preparing the solution; crystals which have turned white should be discarded.

In dosing goats, one may use a metal dose syringe or a rubber tube with a funnel at one end and a piece of metal tube at the other end. The solution should be given slowly, and ample time should be allowed for the animal to swallow. In order to avoid injury to the animal, it is advisable to have a veterinarian administer the treatment.

The use of wide range and dry, hillside pastures is an aid in preventing stomach worm infestation, but the use of small ranges facilitates infection. Enclosures free from vegetation are not so dangerous as those containing vegetation. Cleaning out the manure frequently and thoroughly is an aid in keeping the enclosures safe. Pasture rotation is also an aid in control and should be practiced whenever possible. Wherever it is impossible to use these aids to control and goats must be kept constantly on small pastures, the routine use of the 1-percent solution of copper sulphate every 2 or 3 weeks is a valuable control measure.

Stomach worm infestations are sometimes complicated by the presence of other parasitic worms, such as hookworms, and the addition of nicotine sulphate to the copper sulphate solution, in the proportion of 1 ounce of 40-percent nicotine sulphate to 1 gallon of 1-percent copper sulphate solution, makes a more effective solution for the control of these mixed infestations. A more extended discussion of this subject is given in Farmers' Bulletin 1330, *Parasites and Parasitic Diseases of Sheep*, a bulletin of value to goat raisers, since sheep and goats have many parasites in common.

MALTA FEVER

The disease known as Malta fever has been enzootic on the island of Malta for many years, and its presence in other parts of the world has been recognized from time to time. In the United States it has been found in Texas, Utah, Arizona, and New Mexico. Its origin in these States is not definitely known, but it is stated that it prevailed in Texas when the common goat was the only type in the country. The disease can be transmitted to man. In localities where the disease is prevalent it is important to pasteurize or scald the milk before using it.

ABORTION

Goats, like all other species of farm animals, sometimes abort. The abortion may be caused by infection, lack of some necessary element in the diet, or other factor about which little or nothing is known.

If several repeated abortions should occur in the herd, infection of some kind may be suspected. In such a case it would be advisable to have the aborting goats, or even the entire herd, blood-tested for Malta fever. Goats affected with this disease are apt to abort, and although the danger is remote that Malta fever will appear among goats except in those restricted localities where the disease is known to exist, nevertheless this possibility exists. The test for Malta fever is the same as that for Bang's disease.

If a doe aborts she should be placed in a pen by herself, away from the herd, and kept isolated until discharges from the generative organs cease and recovery is complete.

The fetus and afterbirth, provided the latter has been expelled, should be disposed of in such a manner as to be inaccessible to the rest of the herd. Similar disposition should be made of the discharges from the genital organs and of contaminated bedding.

Pens in which abortive goats have been isolated should be well cleaned and disinfected before being used again.

Little can be done or is necessary in the way of treatment beyond attention to the comfort and nourishment of the animal. If the afterbirth is retained for more than 24 hours or if there is evidence of severe inflammation of the uterus it may be advisable to introduce into the uterus, through a sterile soft-rubber tube, 2 to 3 ounces of mineral oil to which has been added a half dram of iodoform. In some cases this treatment appears to render the attachment of the afterbirth to the womb less firm and to prevent excessive bacterial infection of the organ.

MINOR AILMENTS

CONSTIPATION

Constipation sometimes occurs, especially in the kids. Simple constipation may be due to digestive disturbances resulting from accumulations of poorly digested dry feed, lack of exercise, or gorging.

A change of diet and adequate exercise may serve to relieve this condition. When medication is required such simple drugs as Epsom salts or oil may usually be safely administered as a drench.

The dosage for mature stock is from 2 to 4 ounces of salts dissolved in 1 pint of warm water. Weanling kids should receive only half that dosage. Castor oil or raw linseed oil in place of Epsom salts will be effective, and the dosage should consist of the same number of liquid ounces.

MASTITIS, OR CAKED UDDER

When mastitis is present the udder usually feels hard and is hot and swollen, but an occasional case may be found in which there are flakes in the milk and very little swelling of the udder. The condition is caused very frequently by the presence of bacteria which

multiply in the milk and tissues of the udder and set up inflammatory changes. Injuries, excessive accumulation of milk in the udder, rough milking, chilling, and systemic derangements favor the development of the disease-producing germs. The diseased animal should be promptly removed from the herd and treated. Treatment consists in milking the animal thoroughly but gently every hour or two during the day. The application of hot towels or water as hot as the hand will stand for 20 minutes four to five times a day will also be found to be of benefit. Following the heat treatment the udder should be dried with a clean towel and massaged gently with lard, petrolatum, or camphorated oil, after which the secretion brought down during the massage should be stripped out.

SORE TEATS

This condition may be caused by the teeth of the kids, warty growths on the teats, or an injury. After the teats have been washed and dried, carbolated petrolatum should be applied.

FOOT ROT

Unless properly managed, goats may have foot rot. The first evidence of this trouble to attract attention is a slight lameness, which rapidly becomes more marked. The foot will become swollen and warm to the touch. In treating, first trim the affected feet thoroughly so as to expose the seat of infection, then soak in a saturated solution of copper sulphate (2½ pounds to 1 gallon of water) for several minutes. Remove the animal to clean dry quarters and repeat the copper sulphate treatment when necessary. Pine tar applied to the feet is useful to promote healing after the infection has been controlled.

LICE

Goats frequently become infested with lice. Treatment has been discussed under dipping. When this is not practicable, because of inclement weather, powdering with sodium fluoride is very effective in the control of biting lice. Care should be taken not to apply the powder to the exposed mucous membranes, such as those of the nose or anus. For sucking lice a contact poison is necessary; and when dipping is not advisable, insect powders composed largely of pyrethrum and naphthalene may be used as a control measure. Insect powders are not satisfactory for eradicating this type of lice, however, and either a dip or spray should be used when weather conditions become favorable. A more extensive discussion of this subject is given in Department Leaflet 13, *Sheep and Goat Lice, Methods of Control and Eradication*.

MILK-GOAT REGISTRY ASSOCIATIONS

The American Milk Goat Record Association was organized in 1903. The object of this association is to establish and improve the breeds of milk goats in America; to collect information on the history and pedigree of the best milk goats wherever found and to preserve such records; to publish as much of such information as is

deemed advisable by the board of directors; and to exhibit milk goats at such times and places and under such regulations as the directors decide. This association had recorded 78,992 animals by December 31, 1944.

The American Goat Society, Inc., was organized in 1935. The object of this association is to preserve and perfect the registration of purebred goats exclusively and to develop and sponsor activities designed to promote the dairy goat industry.

In 1939, the International Dairy Goat Record Association that had been registering milk goats from the time it was organized in 1927, united with The American Goat Society, Inc., which association now represents the consolidation of the two former associations. It continues under the name of The American Goat Society, Inc., and had recorded 22,728 animals by the end of December 1944.

The names and addresses of the secretaries of the organizations mentioned may be obtained on request from the Bureau of Animal Industry, Agricultural Research Administration, United States Department of Agriculture, Washington 25, D. C.

